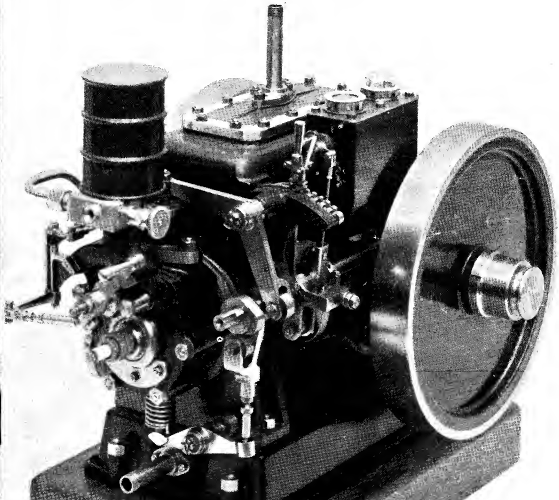
THE MODEL ENGINEER

Vol. 100 No. 2495 THURSDAY MAR 17 1949 9d.



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, *GREAT QUEEN ST., LONDON, W.C.2*

17TH MARCH 1949 VOL. 100 NO. 2495

SMOKE RINGS

Our Cover Picture

● THE HORIZONTAL 15-c.c. petrol engine shown in this photograph was built by Mr. R. L. A. Bell, of Yeovil, and exhibited at the 1948 "M.E." Exhibition, where it gained the award of a bronze medal and the Wellingham Trophy. It is an adaptation of the engine designed by Mr. Edgar T. Westbury for the "M.E." Aveling type model road roller, but modified in detail to make it more suitable for use as a stationary engine. Details of these modifications were given by Mr. Bell in an article published in the issue of THE MODEL ENGINEER dated December 30th last. This photograph may serve as a reminder that the model internal combustion engine need not always be constructed on severely utilitarian lines, or simply and solely for high efficiency performance; there is scope for wide variety in its design, and for good workmanship and finish in the visible working parts. The performance of this engine is very satisfactory and it has a wide range of flexibility and control, with complete reliability as a working model.

Model Engineering in the Future

● A PARAGRAPH was published under this heading in our issue for January 20th last, and it has led to us receiving an interesting and heartening letter from Mr. G. G. Caddy, of South Croydon, who writes: "As one of the rising generation, I would like to assure you that we too regret the passing of eminent members of the fraternity, and that among us there is no lack of enthusiasm. We do, however, find ourselves faced with many handicaps which limit our efforts, one of the most serious being the extremely high cost of tools and materials at the present time.

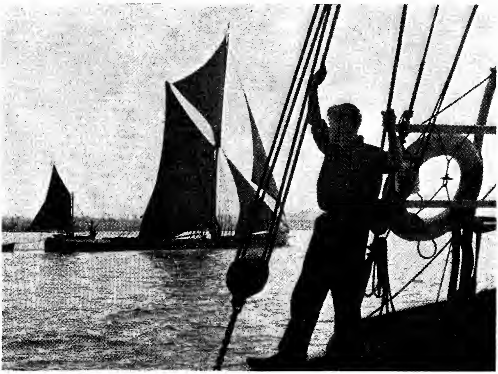
"Many, having served in the Forces, are now studying for professional qualifications etc., and have little time for creative work, and are unable to set up home workshops, due to shortage of accommodation and the high cost of workshop equipment.

"The solution, I feel, lies with the societies and clubs, where we may benefit from the experience of others, and where a well-equipped club workshop would enable us to tackle work that simply cannot be done at home under present conditions. There, no doubt, the steady efforts would be forthcoming, and less emphasis would be placed on the rapid results which you deplore.

"Given the facilities that the older and more experienced members enjoy, you may rest assured that in time we will maintain and improve upon their high standard."

Thames Barges

● ALTHOUGH THERE are still quite a number of spritsail barges on the Thames and about the estuary, they are gradually being superseded, and opportunities of seeing them under sail are consequently diminishing. The ship shown in the picture on this page is the well-known barge *Cambria*, one of the larger coasting types, and famous for her successes in the Thames Barge Races held before the war. She is shown returning from a coastal voyage and is being hailed by a hand from a similar vessel bound down the river. The fact that they have survived so long against the competition of power-driven vessels is due entirely to the fact that they are still one of the most efficient and cheaply-run type of vessels. They are worked by only two, or at most three, men and carry anything from 70 to 200 tons of cargo. They have no engine or other mechanical power, but with their 5,000 sq. ft. of canvas they certainly do not lack speed. They have been very popular as prototypes for modelmakers, as every "M.E." Exhibition proves, and we feel sure our ship-minded readers will be interested to have such a vivid action picture of one of these fine vessels.



Road Locomotives

● THE INTEREST in the old road locomotives seems to have reached something like fever heat, and many readers have sent us notes of their own and clippings from newspapers, all telling of derelict engines in many parts of the country. One gleam of gladness, however, is the news that, at the moment of writing, a fine Burrell, No. 2894, *King Edward VIII*, is being redecorated at Winchester for use by Miss S. Beach's Circus during the coming season. This should provide quarry for hunters in the Southern counties from now onwards! And we shall be interested to note, in due course, who will be the first to send us a report of finding that engine *at work*.

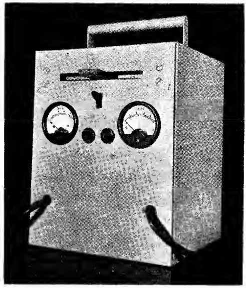
At this time of the year, and again in late summer and early autumn, a few agricultural engines may be found working on farms, and we can only hope that their numbers may not be greatly reduced, though the hope seems to be rather a forlorn one. We wonder if it is now possible for anyone to discover a pair of ploughing engines at work; the last pair we saw working was at a farm alongside the Bath Road, near Aldermaston, Berks, in 1942.

Hobbies Exhibition at East Grinstead

● WE HEAR that the Rotary Club of East Grinstead has arranged an exhibition of Careers and Hobbies, to be held at the Modern School, De la Warr Road, East Grinstead, from April 20th till the 23rd. One of the objects in view is the formation of a Society of Model and Experimental Engineers in the district. In the meantime, readers who may be interested are invited to get into touch with either Mr. E. J. Dakin, 59, Holtye Road, East Grinstead, or Mr. A. G. Cousins, 5, London Road, Forest Row, Sussex.

DESIGNING A BATTERY CHARGER

by R. E. Blakeney

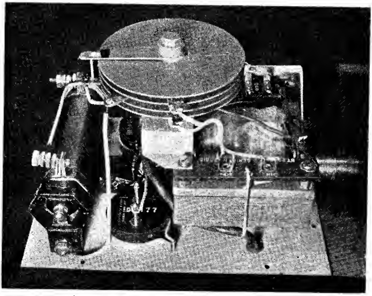


The complete charger. The on-off switch and fuses are mounted between the meters

THE battery charger which is the subject of this article is a direct outcome of the present petrol shortage, and was built for a friend who had been compelled to lay up his car. It would also be equally suitable as a low-voltage supply for experimental work, or for operating many of the items of war-surplus equipment which abound nowadays. Compared with a trickle charger, which seldom delivers more than 1 amp., this unit will provide 4 amps. at 12 volts, and if it is used solely for battery charging, will bring a reasonably large battery up to full voltage in quite a short time.

With a view to reducing the initial cost as much as possible, surplus equipment was used to a large extent, either as bought or modified. The main components, which will be dealt with separately, are the transformer, metal rectifier, ammeter, voltmeter and rheostat. The transformer was originally a power choke, but its winding was discarded, and only the laminations and the core clamps used. In designing a transformer, one has to use trial and error methods to a certain extent, mainly because it is not easy to tell whether a particular size of lamination will accommodate the winding until nearly all the calculations are complete.

In the case under consideration, the laminations were far larger than they need have been, but as the choke was extremely cheap and space not at a premium, this did not matter very much. It is worth remembering that transformer iron is cheaper than copper wire and, up to a point, the more one uses of the former the less one has to use of the latter. This assumes that one is not too particular about losses. Optimum sizes of cores are mostly the concern of those who have to produce transformers in bulk on a commercial basis.



Rear view of front panel, showing the components

The formula used to calculate the number of primary turns was the familiar one:

$$N = \frac{E \times 10^8}{BfA \times 4.44}$$

where E is the supply voltage, B the maximum flux density in lines per sq. in., f the frequency in cycles per second and A the cross-sectional area of the core in sq. in. Having calculated the number of primary turns one only has to divide this figure by the primary voltage to find the number of turns per volt, which

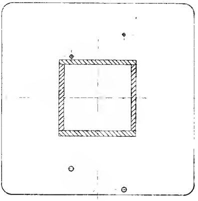


Fig. 1

is used in turn to determine the number of turns for the secondary winding. As we already know the secondary load, the gauge of wire can be found by reference to any wire table, and assuming an efficiency of, say, 85 per cent., the gauge for the primary can be settled in the same way. It should be noted that the output of the transformer must be something like 16 volts to allow for a small voltage drop across the rectifier, but the exact figure should be obtained from the manufacturers. In this instance a bridge-connected rectifier was used but there are other types, some of which require a centre-tapped winding. From the same wire tables can be calculated the space occupied by the windings, and the choice of insulation will be governed to a large extent by the space allowed by the laminations. Enamelled wire produces the most compact winding but it has to be handled carefully to avoid damaging the insulation, so double cotton-covered wire can be used for the sake of economy and ease of construction, but it will occupy nearly double the space. If the winding is to be varnished it must be dried out very thoroughly first, by slow baking, otherwise any moisture in the insulation will only be sealed in and will subsequently produce a fault. A useful compound for protecting windings which are not subjected to any form of heat is a mixture of equal parts of beeswax and resin, which should be melted and applied hot to the windings which have already been heated.

The bobbin on which the primary and secondary were wound was made up from $\frac{1}{16}$ in. "Paxolin," and Fig. 1 shows how the pieces surrounding the core were arranged to wedge one another into position. A little adhesive, such as "Durofix," applied between the cheeks and core pieces will ensure a strong job. Apart from terminating the leads, which can be done in any convenient way, the construction of the transformer is complete.

As we have seen, the rectifier was one of the bridge type which has four connections, two for the a.c. input, and a positive and a negative on the output side. The input tags are sometimes painted green. The input voltage to the rectifier has to be slightly in excess of the nominal 12 volts for two reasons; one has already been mentioned and the other is that, unless the transformer has exceedingly good regulation, the output is bound to fall as the current is increased. This, of course, is a matter of transformer design, and has nothing whatever to do with the rectifier. Figs. 2 and 3 show two methods of connecting the rectifier to the transformer, and the use to which the unit is put will decide which will be used. Fig. 2 gives a more flexible arrangement

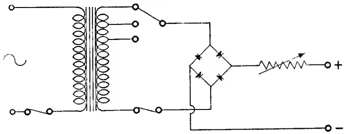


Fig. 2

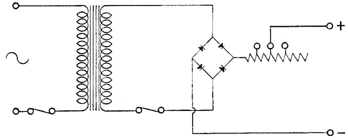


Fig. 3

if the unit is likely to be used for other purposes besides battery charging, but whichever is used it must include a limiting resistance to protect the rectifier against overload. The method of tapping the transformer output is convenient as once the correct voltages have been selected no ammeter is required, but reference must be made to the maker's literature on the rectifier for this information, which will also quote a value for the limiting resistance. It is well to remember, that whichever method of voltage control is used, the charging rate will inevitably fall as the battery voltage rises, and if any attempt is made to increase the current excessive gasing in the battery cells is likely to take place.

All that is now required to complete the charger is an ammeter, voltmeter and a rheostat. The two meters are modified milliammeters, and the one used to measure the current will be

dealt with first. As the maximum output is to be 4 amps. it is reasonable to employ an instrument reading up to 5 amps., and if a 0-500 mA meter is used as a basis for the conversion the problem is somewhat simplified. In order to increase the range of the meter it will have to be fitted with a shunt which will pass a large proportion of the current, and not allow more

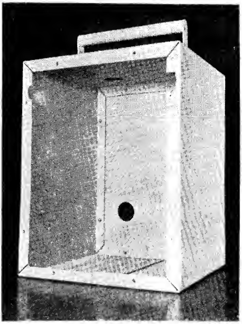
Fig. 4

than the stipulated 500 milliamperes to pass through the meter. The resistance of the shunt is based upon its multiplying factor and the resistance of the meter, which is usually marked on the bottom of the scale. The formula for arriving at the resistance of the shunt is

$$R = r_m/n - 1$$

where R is the required shunt resistance, r_m is the meter resistance and n is the multiplying factor.

If one is fussy about temperature coefficients, manganin wire should be used for the shunt; but in this case a strip of $\frac{1}{4}$-in. × 22-s.w.g. phosphor bronze was used, and it appears to work well. Before attempting to adjust the shunt, two small clamps similar to that shown in Fig. 4 should be made of brass, the size of the hole depending on the type of terminal on the meter. One end of the strip can be soldered to one clamp which can be tightened up in position on the meter, and the other end merely held by the other clamp. Fig. 5 shows the apparatus necessary for adjusting the shunt, and an accumulator of ample size should be used. The ammeter



The case with front panel removed

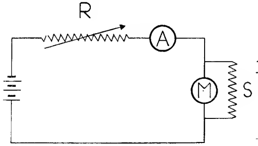


Fig. 5

(*A*) must be capable of reading up to at least 5 amps. and the variable resistance (*R*) must be able to carry this current without serious overheating. To start with, the length of strip between the terminals should be about 2 in. to $2\frac{1}{2}$ in. which will be on the short side for safety's sake. The current is next set to 5 amps. on the standard meter, and the deflection of the new meter made to correspond by altering the length of the shunt. While doing this, great care must be taken to see that good contact is maintained between the shunt and the terminal, because if this is not done there is a possibility of the full 5 amps. passing through the new meter with fatal results. It is probable that this adjustment will slightly alter the current passing in the circuit, so it will have to be brought back to its original value by altering the resistance (*R*) again, and once more checking the new meter. Once the readings of the two meters coincide, the loose end of the strip forming

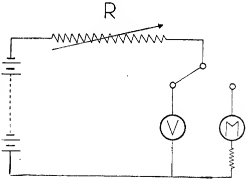


Fig. 6

the shunt can be soldered, and the surplus cut off. As the scale is a linear one it only remains to fill in the intervening values, and the meter is ready for use.

Although it would be a considerable luxury in the ordinary course of events to use anything as sensitive as a 0-1 milliammeter as the basis

for a voltmeter in a battery charger, it was done in this case as one which had cost only a few shillings and was "in stock." It was decided that the meter should be made to read up to 20 volts, which necessitated a series resistance of approximately 20,000 ohms. This value being obtained by using Ohm's law

$$R = E/I$$

where R is the resistance in ohms, E is the voltage and I is the current in amperes. It should be noted that the total resistance of 20,000 ohms will include the resistance of the meter movement, so we shall have to obtain a resistance slightly lower than 20,000 ohms and make up the total with an odd length of resistance wire. Radio resistors accurate to 1 per cent. can be bought for a few shillings and serve admirably for this purpose. The circuit shown in Fig. 6 is used to calibrate the new meter, from which it can be seen that the voltage is set to a known value as shown by the standard meter, which is then replaced by switching into circuit the new meter. The voltmeter series resistance is then increased or decreased until a corresponding deflection is obtained on the new meter. In this way the scale can be calibrated at intervals of, say, 5 volts, and the 1 volt marks put in by eye.

The rheostat for controlling the output completes the list of items, and its value will depend upon the use to which the unit is to be put, and the way in which the circuit is arranged. The rectifier manufacturers usually quote a value for this resistance, but if this information is not readily obtainable a value of about 10 ohms will cover most eventualities. For battery charging only it would be more convenient to use a lower value to avoid cramping the control into a small part of the resistance's track. The rheostat must be able to handle at least 5 amps. without undue heating, and any generosity in this direction will not be misplaced. Fig. 7 shows the circuit of the complete charger, and all wiring should be carried out with 16-s.w.g. wire for the sake of rigidity and the current that it has to carry.

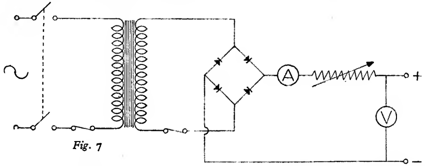


Fig. 7

The design of the case is a matter of personal taste, and this one was made of 18-s.w.g. aluminium which was bent up into a long channel, and then bent again at right-angles four times to form the top, bottom and sides. The back and front were attached by 4-B.A. countersunk head screws. Adequate ventilation was arranged by punching two 1-in. holes in the back and top, and the case was finished with two coats of cellulose enamel put on with a spray.

For the Bookshelf

Patent Applied For; A Century of Fantastic Inventions. By Fred Coppersmith and J. J. Lynx. (London: Co-ordination [Press & Publicity] Ltd.) Price 10s. 6d. net.

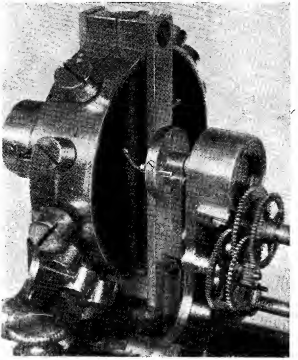
There are many people who hold that all inventors are mad—harmlessly or dangerously, according to whether their activities concern mousetraps or atom bombs. While there is plenty of evidence to refute this sweeping allegation, in the way modern inventions have improved the amenities of life, even to the extent of becoming sheer necessities in some cases, it is true that many inventions which have been or still are being produced are futile, frivolous or fantastic. Inventors have in many cases spent their whole lives in producing inventions that will not work, that nobody wants, or that confer no practical benefits on the community. In the files of the Patent Office may be found the specifications of innumerable patent specifications which, to the enlightened reader of today, may appear in the light of a "comic supplement"—but between the lines one may read many a human story of patient effort, disappointment, frustration, and even tragedy.

This book is written in a light vein, and apart from its technical aspect, makes very entertaining reading. It describes inventions in the realm of domestic, personal and sartorial equipment, modes of travel and transport by land, sea and air, music and entertainment—all of which have been fruitless or born out of time. The authors have not forgotten to include a chapter on fantastic inventions which have never been intended to go farther than the pages of a "Penny Dreadful," including the delightful creations of Frank Reade, which many of us remember from our boyhood days; also, the works of Jules Verne, nearly all of which have now been fulfilled in practice, or even superseded.

*The "Eureka" Electric Clock

by "Artificer"

THE housings in the two motion plates contain the bearings for the balance wheel pivots, which are essentially identical for each side and are of rather unusual design. As will be seen from the bearing assembly design, the pivot rests on two large steel balls, which in turn roll inside a hardened ring or "race," in a very restricted orbit, the limits of which are determined by the holes in the plate which abuts against the outside edge of the race, and is held in place by a glass disc and a screwed retaining ring. The chamber enclosing the ball-race is capable of being used as an oil bath to keep the bearing well lubricated, so long as it is not filled above the level of the pivot clearance-hole, and the clock is not moved out of its normal vertical position.



A close-up of the clock movement, showing contact mechanism and gear train

It will be clear that this type of bearing is suitable only for a shaft having an oscillatory motion, as distinct from one which rotates completely and continuously in one direction; and even then, the extent to which it can provide true rolling motion is very limited, as the balls tend to roll bodily within the race, which they cannot be allowed to do except to a very small extent. Should there be a tendency to exceed this, the balls will rub against the edges of the holes in the plate, causing some friction, and this may possibly be a deliberately designed effect to deter the balance wheel from swinging through too great an arc. To prevent the possibility of the balls becoming wedged in the holes, such as by inertia effects when the clock is moved violently, banking pins are fitted to the inner wall of the housing as an emergency limiting measure, and these also would cause friction if the balls made contact with them.

The endwise movement of the balls is prevented by the inner wall of the housing on one side and the glass disc on the other, and very little clearance should be allowed. It is possible to observe the rolling action of the balls through the glass disc, and also to see that the oil bath contains sufficient lubricant of the proper consistency and cleanliness.

Pivot Bearing Components

Details of the component parts of the bearing are given in Figs. 10, 11 & 12. The ball-race may be made either of silver-steel, hardened right out in oil, or mild-steel case-hardened.

If the pivot journals are made larger in diameter than the specified size, as suggested, it will be necessary to make the inside diameter of the race also larger, and in any case it will be desirable to "offer up" the assembly before hardening, or to make a dummy race to obtain the correct location of the pivots, as near as possible concentric with the housing, but at least close enough to avoid fouling the clearance holes in the latter. The inner surface of the race is parallel, without the concave track usually provided in standard forms of ball-races, and the width of the race is less than the diameter of the ball, by an amount approximately equal to the thickness of the abutting steel plate. After hardening, the race should be highly polished on its working surface.

It will be seen that the steel plate is provided with a locating tab, which fits in a keyway or recess formed in the wall of the housing; this does not extend to the outside of the threaded end, however, and is best formed by drilling, or chipping out with a small chisel. In order to ensure that the holes in the plate are symmetrical, relative to the vertical centre of the housing, it is advisable to locate the plate in this way before marking out and drilling them. Burrs must be carefully removed from the edges

**Continued from page* 253, "*M.E.*," *March* 3, 1949.

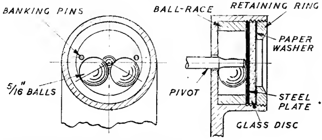
of the holes, and they should be polished with the rest of the surface on both sides of the plate, after hardening. As the plate is thin, case-hardening is not very satisfactory, and it is better to use thin carbon-steel gauge plate or "pen steel" for making it.

There may be some difficulty in cutting or obtaining small glass discs, and the possibility of using a plastic substitute such as Perspex or cellulose acetate may be considered; but it should be noted that these discs act as end-locators for the steel balls, and it is therefore desirable to use as hard a material as possible. A useful tip for cutting glass circles is to use a chip of tungsten carbide set in a radially adjustable holder like a washer cutter or trepanning tool; it may be run either in the lathe or the drilling machine.

Should the end clearance of the balls be insufficient to allow free movement, a paper washer similar to the one outside the disc, but having a hole $\frac{11}{16}$ in. diameter, may be used between it and the steel plate. It seems obviously desirable to fit a washer in this position, but it was not done in the clock examined. The screwed retaining rings for the housing may be machined in one piece from brass rod, and their fit in the housings tested before parting off. They each have two blind holes drilled diametrically opposite to each other for the application of a pin spanner. A trace of varnish on the paper washers, and on the threads of the rings, will assist in ensuring oil-tightness of the housing.

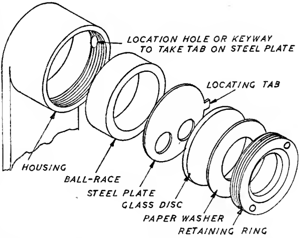
When the motion plates are fitted to the studs of the armature plate, and the balance wheel assembled in place, the pivots should have just perceptible end shake between the steel plates in the two housings. Adjustment of end play can be obtained either by fitting shims on the armature studs or machining back the shoulders of the studs as required.

Should the construction of this rather elaborate form of pivot bearing be objected to by constructors, an alternative would be to use the smallest obtainable standard ball-race, or better still, one of the tiny Swiss ball-races specially made for instrument work. A cup-and-cone form of bearing like that of a cycle hub, the cone being formed on the pivot and a carefully machined and hardened cup fitted to the housing in place of the parallel ring, is also a possibility, but it should be noted that ball-bearings of this type require close end adjustment to work satisfactorily. Workers who have experience with fine horological work may be able to fit jewel bearings and endstones to the pivots in such a way as to produce little, if any, greater friction than a ball-race.



Left—Fig. 10. *Pivot bearing and housing assembly*

Below—Fig. 11. *Exploded view of bearing assembly*



Contact Spring Assembly

This is shown, together with details of the components, in Fig. 13, and it will be seen that the spring is held by means of two 6-B.A. screws, to the vertical edge of a block of ebonite or other insulating material, which in turn is attached to the back of the front motion plate by a single 6-B.A. screw. The contact spring itself is backed up by a check spring of the same material and thickness, to prevent excessive flexure near the root of the free end, and a further backing is provided by a rigid plate of $\frac{1}{8}$-in. brass strip. All these components are of a simple and straightforward nature, the only point which calls for detailed comment being the tipping of the contact spring with a small L-shaped piece of silver or gold-silver alloy. Both in obtaining the material, and in attaching it to the spring, some constructors may experience difficulties, but in such cases it is probable that nearly any working jeweller would be able to assist in both respects. Silver is quite a satisfactory metal for a contact of this type except for its tendency to tarnish, especially in an atmosphere containing sulphur compounds, as in industrial towns; but as there is wiping contact of the conductors, they are

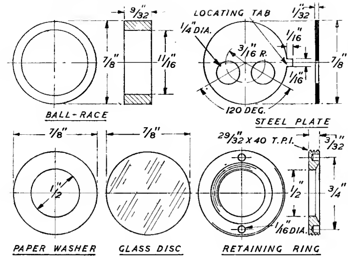


Fig. 12. *Components of pivot bearings (less steel balls)*

largely self-cleaning when kept in continuous use. The silver-gold alloy, however, does not tarnish, and being slightly softer than the silver or german-silver contact pin, acts as a lap to improve its polish.

The best material for the contact and check springs is a clock suspension spring strip of approximately the specified thickness. This material, although finely tempered, can be cut quite easily with sharp shears, and also filed; drilling, however, may present more difficulty, but it may be accomplished successfully with a glass-hard spear-point drill, made from silver-steel and hardened right out in water at the extreme tip; it should be run fairly slowly and lubricated freely with turpentine. It will be noted that the screw holes in the contact spring are elongated to allow of slight vertical adjustment; in this detail, some liberty is taken with the original design, as the actual clock examined had no provision of this kind, but it appears to be highly desirable in order to enable exact adjustment of the contact timing to be obtained.

A small hole is drilled at the extreme lower end of the contact spring to assist in soldering the lead to it, but this is not absolutely essential, and it may be preferred to drill and tap the backing place and fit a small terminal screw, which would avoid the necessity for a soldered connection, and would be quite satisfactory from the electrical aspect if due care is taken in the metallic contact of the parts.

When the springs are mounted on the block and the latter attached to the motion plate, it is possible to adjust the block by pivotal motion on its single screw, so that the correct action of the contact gear is obtained; in other words, that the contact pin touches the spring on its metallic side on the clockwise swing, and on the insulated side of the return swing. This action should be possible

(*Continued on page* 331)

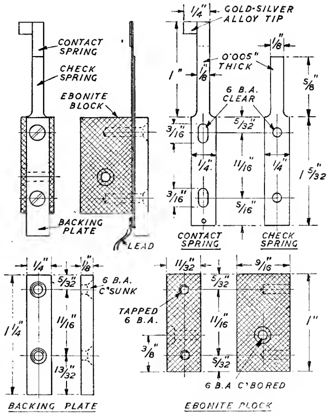


Fig. 13. *Details of contact spring assembly*

A Domestic Bell and Indicator System

by J. Gordon Hall

IN these days when so many people live in "flats," particularly converted houses and apartments where there is no resident housekeeper, the system of bells and indicators here described will be found to be a very real time and labour saver.

The system may be easily and cheaply constructed and installed by any amateur with practically no skilled work or technical knowledge, and the simplest tools, and its construction and installation will be a very instructive and interesting experience. The few components—other than the electric bells or buzzers, etc., in common use—may be obtained at little cost from advertisers of government disposal goods.

The system consists of the usual bank of "bell-pushes" on the front door or main entrance, wired to the usual bells or buzzers situated in the tenants' apartments, the system being operated from a battery or preferably a "bell transformer" which can be purchased from any electricians. Two improvements, however, are incorporated, which I believe are quite original: first, an indicator panel which shows who is "In," "Away," or "Out," is situated at any convenient point, for instance in the entrance hall, and second a small panel situated on the bank of bell pushes indicating if a tenant is out when his bell push is operated.

The indicator panel carries a three-position "key" switch connected to, and corresponding with each push and bell.

The three positions of the key switches are "In," "Away," and "Out," and are turned to the appropriate position by the tenant as he enters or leaves the premises. The "away" position is adopted when the tenant is not returning that night, and its value will be seen in a moment: the indicator panel also carries a small "pilot" lamp which remains alight until

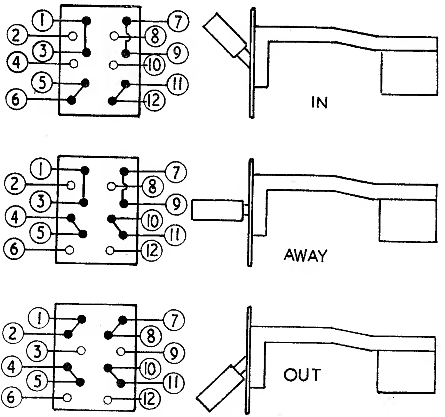


Fig. 1. Key-switch diagram

the last switch is turned to the " In " position, but which ignores the "Away" position; thus when the last tenant returning that night turns his switch to the " In " position, this pilot light goes out *irrespective of any switch or switches which may be at the " Away " position*, so warning this tenant that he is the last in and should, as a matter of routine, lock up, put the cat out or in as the case may be, and generally word " Out " is illuminated, and becomes visible to the caller, advising him that the tenant is not available, and thus saving him the trouble of waiting, and other people the trouble of answering the door.

The device is, in fact, an automatic footman, and the interest shown in the installation in the writer's own house, and the many requests for information as to " how it is done," and for the

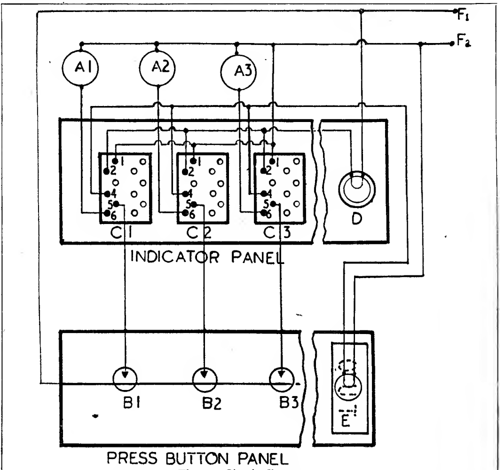


Fig. 2. Circuit diagram

secure for the night. The writer has added to his installation a further refinement in the shape of an electrically-released door-bolt, which is shot home automatically when the last switch is turned to " In " ; if sufficient interest is apparent, he will, with the Editor's permission, describe this very simple piece of apparatus in a later article.

The bell-push panel incorporates a small panel of opaque glass, upon the reverse side of which the word " Out " is painted, and behind this panel to illuminate it is a small lamp so connected that when a push is operated, the corresponding indicator key switch of which is either at the " Out " or " Away " position, the

job of installing " one in my house," has led him in self-defence to write this article, so that people can get ahead with it themselves, leaving him some small space of time to carry on his normal occupations ; doubtless, some of our more commercial readers will eventually market the device, which the writer has NOT patented.

The name of each tenant, or the number of the flat, is of course, marked clearly against each push-button and indicator switch, and a clearly printed card of instructions placed over the indicator panel. These instructions can be quite brief, and the operation is so simple that even the least intelligent tenant can be induced to operate his switch correctly in a few simple and

well chosen words [!]. If a tenant forgets to attend to his switch, and gets locked out for the night, he will soon learn better.

It is possibly a wise precaution that one switch should always remain at the "In" position, or a dummy push be fitted, so that any caller with felonious intent is left in doubt as to the premises being vacated or not.

The circuits are quite simple and should present no difficulty if the diagrams are carefully followed.

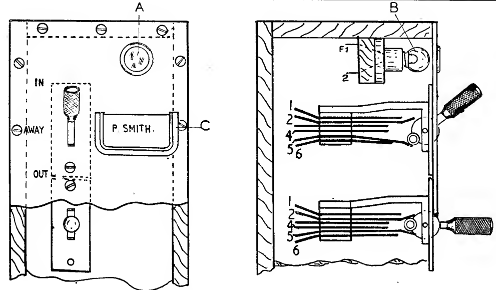


Fig. 3. Indicator box and panel

Indicator Panel Unit

The three-position key switches used by the writer were obtained from a "Pattern 55432 Code Selector Unit" obtained from an advertiser in THE MODEL ENGINEER (Clydesdale), and the combination and sequence of contacts are clearly shown in Fig. 1, the left-hand diagram representing the terminal tags at the back of the switch, corresponding to the positions of the lever as shown at the right-hand of the diagram. Note that the contacts are *not* symmetrical, and it is important that the switches are mounted right-side-up as shown.

It will be observed that for our purposes we only use the contacts which I have numbered 1, 2, 4, 5 and 6, but I have given a diagram of all the contacts, as this may be useful to readers who wish to use this switch for other purposes.

This type of switch is obtainable in a great variety of combinations, but one that gives the same sequence and combination will serve. I believe that several advertisers can supply switches only, without buying the whole unit.

The theoretical circuit for the whole system is illustrated in Fig. 2, where $A1$, $A2$, $A3$ are the bells or buzzers (only three are shown, but of course, any appropriate number may be adopted), $B1$, $B2$, $B3$, the bell-pushes, and $C1$, $C2$, $C3$, the indicator panel key switches to correspond. Fig. D is the warning light on the indicator panel (which goes out when the last switch is turned to "In"), and E the lamp on the bell-push panel which illuminates the "Out" panel. $F1$ and $F2$ are the connections to battery or transformer.

Fig. 3 shows a portion of the indicator unit, with the mounting of the key switches and warning light. It is recommended that the actual panel is constructed from 16 s.w.g. brass or aluminium sheet, screwed to a stout box made from ⅜-in. wood. A window A is cut in front of the warning lamp B, which may be filled with a piece of coloured glass of plastic; actually the writer used a small tubular lamp and "eye" of the type employed on Manual Telephone Exchange boards. These are also obtainable, but possibly are in short supply. An ordinary flash-lamp bulb may be used, and a holder fastened to the box in the appropriate position by a small wooden or metal bracket.

The theoretical circuit diagram, Fig. 2, illustrates the key switches as being side-by-side, but in practice, most readers will probably prefer to place the switches vertically, as shown in Fig. 3.

To facilitate external connections and circuits when wiring up, it is advisable to fit a terminal block to the unit, a strip of ebonite or other insulating material with a row of soldering tabs screwed thereto can be used, and each tab should be marked with a number or letter for identification. Here again, very nice terminal strips are available from advertisers, and it is best to solder all connections, as this is far more reliable than clamping under screw-heads.

(*Continued on page* 319)

Improving the Small Lathe

by J. Stebbings

THERE must be many model engineers, especially amongst the very young just taking up the hobby, who for reasons of economy or lack of a workshop must content themselves with one of the very small cheap lathes now on the market. These machines vary in size from 2 in. centres to 1½ in. centres and are obviously built as cheaply as possible. Although lacking in robustness and precision, it must not be thought that good work cannot be turned out on them. Nevertheless, a little time spent on the machine itself will enable worthwhile amendments to be made which will improve the quality of the work and simplify operation of the lathe. The writer has recently carried out a number of improvements to his Super-Adept lathe, which are especially commended to the beginner who, by reason of his inexperience, will find it difficult to distinguish between his own lack of skill and the limitations of the machine, in deciding on the reason for the faults in his work.

Work was commenced on truing-up the slide surfaces and adjusting the gibs. The operation was limited to careful scraping and rubbing with a small triangular slip of India stone. Enthusiasm should be severely curbed here, as there is a

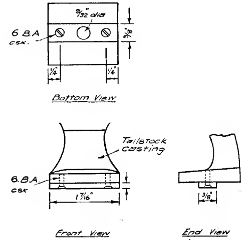


Fig. 1. Tailstock lug

danger of too much metal being removed and the alignment being disturbed. Excellent articles on this subject by "Duplex" have appeared in THE MODEL ENGINEER dated September 9th and 23rd, 1948, under the title "Machine-tool Slide Gibs and Locking Devices," and it is unnecessary to repeat the good advice offered.

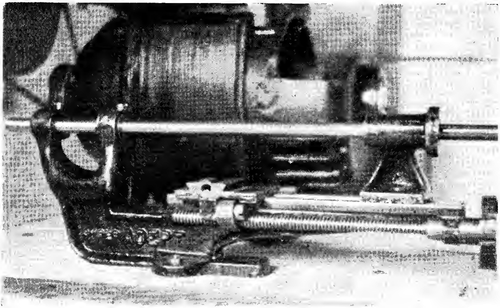


Fig. 2. Aligning the tailstock by means of a bar passed through the mandrel bearings and tailstock casting

Tailstock

The next component tackled was the tailstock. This was originally aligned by a lug, cast in one with the body and sliding in the central slot in the bed. Considerable side-play existed between the lug and the slot surfaces making it difficult to set the centre for parallel turning. The lug was filed off flush with the bottom of the horizontal surface which makes contact with the top of the bed. A new lug was then made as shown in Fig. 1. This was cut roughly to size from $\frac{1}{8}$-in. mild-steel and the sliding surfaces were ground by rubbing on a new carborundum stone until the lug would slide smoothly along the bed. For ease in grinding and in testing the fit, it was held by means of a bolt through the central hole. The holes for the 6-B.A. bolts were drilled tapping size only for the time being. The fixing of the lug to the tailstock in correct alignment was made easy by reason of the fact that the mandrel and the tailstock barrel were each $\frac{3}{8}$ in. diameter. These parts were removed from the lathe, and a piece of $\frac{3}{8}$-in. diameter silver-steel was passed through the mandrel bearings, and the tailstock (Fig. 2). The new lug had previously been loosely bolted to the tailstock through its central hole and an anti-vibration lock washer placed under the head of the bolt. The bolt was $\frac{1}{8}$ in. diameter and allowed plenty of clearance for final adjustment. With the silver-steel in position the nut was tightened and the adjustment checked by moving the tailstock along the bed and also by checking the parallelism of the bar by traversing a tool from end to end of the bed. The tailstock was then removed and drilled with a 6-B.A. tapping size drill passed through the previously drilled holes in the lug. For this operation a toolmakers' clamp was put on the lug as an additional precaution against movement whilst drilling. The body was then tapped 6-B.A., and the lug holes opened out to clearance size and countersunk. The lug was then secured permanently in position.

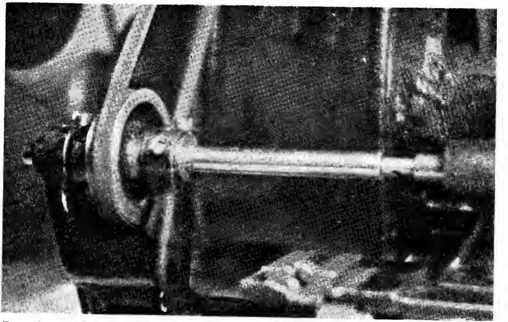


Fig. 3. Boring the headstock bearing. The cutter of the boring bar can be seen just about to start the cut. Note small gap between pulley and left-hand bearing, as mentioned in the text

Mandrel Bearings

The mandrel bearings were the simple split type, which have the disadvantage that no amount of tightening would prevent sideways play once the bore had become worn. It was therefore decided to bore out the bearings to allow the fitting of split bushes. For this purpose a boring bar was made from $\frac{3}{8}$-in. diameter silver-steel in the following manner.

A piece $5\frac{1}{2}$ in. long was cut, and the ends cleared of burrs and filed roughly square. The bar was then placed in the headstock in place of the mandrel, with the pulley mounted in the usual way. One end of the bar was faced-off and centred, and after reversing the bar end for end the opposite end was faced and centred in the same way. A $\frac{1}{8}$ in. diameter hole for the cutter was drilled transversely in the exact centre of the bar, and a small cutter $\frac{3}{8}$-in. long made from $\frac{1}{8}$-in. diameter silver-steel. This was held in position by a 6-B.A. grub-screw which was cut so that it was below the surface of the bar when tightened.

Before boring the right-hand mandrel bearing, it was necessary to make the bush. This was bored just under $\frac{3}{8}$ in. diameter to allow for reaming, turned outside to $\frac{7}{16}$ in. diameter and finally

split with a slotting saw. The boring bar was placed in the mandrel bearings so that the cutter was just on the outside of the right-hand bearing. The pulley was tightened hard up against the inside of the right-hand bearing. The adjusting screw of the right-hand bearing was slackened as far as possible and that of the left-hand bearing adjusted for a good running fit. The right-hand end of the boring bar was supported by the tail-stock centre (Fig. 3).

With the cutter adjusted for a light cut it was fed into the bearing by means of the tailstock. After about $\frac{3}{16}$ in. depth had been bored the pulley came up against the left-hand bearing so stopping the feed of the bar. The lathe was then stopped and without moving the bar the pulley was slackened, brought into contact with the right-hand bearing again and retightened. The boring operation was then continued and the process of moving the pulley repeated until the cutter had traversed the width of the bearing. Further cuts were taken until the bush was a good tight fit in the bearing.

The bush was fitted and the oil hole drilled. It now remained to ream the bush; and this was done in the following manner. A $\frac{3}{8}$ in. diameter reamer was made from silver-steel as shown in Fig. 4 and suitably tempered. It was pushed through the left-hand mandrel bearing and after adjusting to a fairly tight fit it was fed into the bush in the right-hand bearing to complete the reaming.

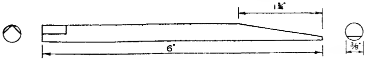


Fig. 4. The $\frac{3}{8}$-in. diameter reamer

At the time of writing the writer has not found it necessary to fit a bush to the left-hand bearing, but there is no reason why this should not be bored out in a similar manner. The cutter would have to be transferred to a new position on the boring bar, so that the tip takes up a position from one end equal to the width of the bearing. It is suggested that the pulley should be fixed on the bar between the right-hand bearing and the tailstock. This will require a temporary movement of the lathe in relation to the countershaft.

It is hoped to describe in a further article the making of various accessories and a countershaft.

A Domestic Bell and Indicator System

(*Continued from page* 316)

All internal wiring should be neatly carried out, as in a wireless set, using a heavy gauge wire and insulating sleeving where necessary.

As shown in Fig. 3, a small "pocket" *C* of brass or aluminium should be fixed against each key switch to take a piece of card with the tenant's name neatly printed thereon; if a strip of white celluloid is available, the name may be printed on in indian ink, but if paper or card is used, it is advantageous to wrap them in cellophane to keep from getting soiled.

There is, of course, no objection to making the panel out of wood, but metal is more durable. The writer constructed his of 16-gauge sheet brass, enamelled "crinkle" finish Post Office red, and the positions of each switch engraved "In," "Out," "Away."

Bell-push Panel

As this unit is usually exposed to the weather, it is better made from sheet-metal and good quality weather-proof press-button units used, with pockets to hold the nameplates, which may be painted on thin metal and varnished; the writer used engraved and sealing-wax filled name-plates, as he had access to an engraving machine.

The construction of the press-button unit is similar to the indicator unit, and the small panel carrying the "Out" sign can be a strip of glass or translucent plastic, with the word "Out" painted on the reverse (inner) side: a small lamp is fitted in a similar manner to the indicator panel, behind this window to illuminate it. The internal wiring should be carried out neatly as described for the indicator unit, and a terminal strip fitted, with the tabs numbered to correspond with the connections.

The writer made up his own bell-pushes, making them very substantial and absolutely weather-proof, because at the time no very satisfactory bell-pushes were available. If anyone is interested in making his own unit, possibly the Editor will permit me to describe one in a further article. It has been pointed out that we have several useful-looking contacts to spare on the indicator switches, and many and I regret to say some ribald suggestions have been made to me as to what purpose they may be put. Doubtless some of our more ingenious readers will think of something. . . . ?

*TWIN SI

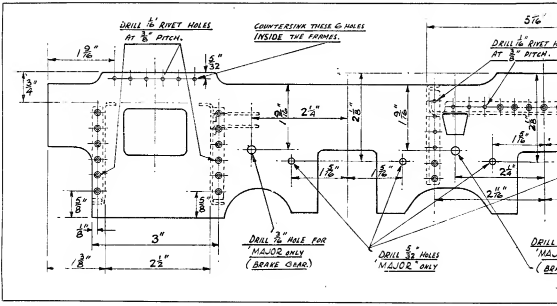
by J. I. Auste

Two 5-in. gauge locomotives, exactly alike ext

THE drawing reproduced herewith shows the main frames once more, this time for the purpose of locating all the principal drilled holes. I cannot, at this stage, guarantee that each and every hole is put in, and, in the later stages, there will be holes that appear in one or the other side only. To put these in would most likely cause confusion at this stage of the work.

However, the holes for the spring-hangers and brake-arms are there, and quite a large number of rivet holes that will be required quite soon for the fixing of the various stretchers and diaphragms that form a sturdy and interesting internal structure.

I don't think anyone will have occasion to complain about lack of stiffness, in spite of the fact that the buffer-planks at both ends are only plain strips of either $\frac{1}{8}$ in. or 5/32 in. material. In most small locomotives the practice of using an angle section, slotted out to take the frames, is now almost universal, and very good it is too. The danger of using this system lies more in the lack of accuracy in the width and alignment of the cut slots when finished. An incorrect slot is not only useless, but almost impossible to correct without a certain amount of "bodging-up." In both "Major" and "Minor" the basic construction is the same, so we can go along together a little while yet. The first divergence comes with the stretchers, or rather the detail work in them, and here you can still take your choice of types according to how well you want your locomotive to look when finished. Right at the front of the frames and level with the cylinder-covers, there is a $\frac{1}{16}$-in. mild-steel stretcher. This one is well in view, as you can see from the photograph, and has three inspection-covers in it. I am not going to suggest that anyone will have occasion to remove the covers, and if they did, no useful servicing could be carried out through them. I regard their inclusion as a super-detail item only. For "Major" I most certainly suggest using them, and the little covers could be made and riveted on with $\frac{1}{16}$-in. rivets without even having an aperture behind them to cover. I shall most probably make these apertures myself for conscience reasons (you remember what I told you!) but it wouldn't really matter if they were not there. In "Minor," this stretcher could be made up in perfectly plain sheet and left at that.



The second stretcher, that comes in line with the back ends of the cylinders, serves a double purpose. This has a slot running across it near the top edge and on the back of the plate is fixed a pair of angle cleats; they will carry the pin for the front draw-hook eye. This is an essential feature for both locomotives and does a job of work. The other cut-outs are, in a sense, more ornamental than useful, so use your own discretion as to which you adopt. It is interesting to note, at this stage, that when the locomotive is hauling bunker first there is no pulling strain on the front buffer-plank. It is transmitted right back to the number two stretcher just described and to which the draw-hook, with its long swinging tail, is attached.

Number one and number two stretchers also

*Continued from page 198, "M.E.," February 17, 1949.

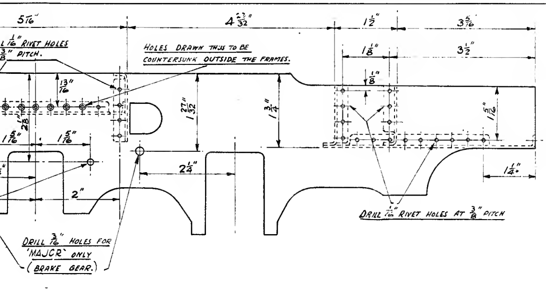
SISTERS

usten-Walton

alike externally, but very different internally

form a box immediately between the two cylinders, just where stiffness is rather essential. On the prototype there is an additional plate member joining the two bottom edges of these stretchers; but, so far, I have made no provision for its inclusion. Being in a readily accessible place for drilling and bolting, we can leave this

In "Minor" I propose to make further use of the diaphragm, and to fit to its underside a type of double-acting water-pump that has been made and tried with great success. If you look carefully at the frames drawing you will see that there is very little room between the axle centres, and to fit a normal type of plunger pump would entail either a short affair giving a nasty angular drive to the ram, or a more reasonably proportioned pump, still eccentric driven, but sloped up to clear either the axle in front or behind it. I don't like long cranked or pivoted levers to cheat out this lack of room, because they absorb too much energy and add complications to the springing system. The sloped-up pump also has a very great disadvantage in that it produces a reactionary



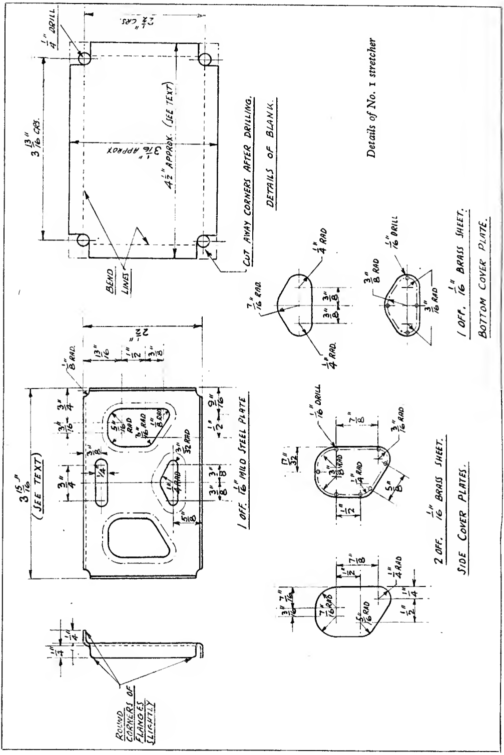
item until later, when the whole locomotive will come under a more detailed examination.

The next stretcher—number three from the front end—is similar to number two, and is fitted nearly midway between the leading and driving-wheel centres. This is a useful place for halfway stiffness. However, it serves another purpose in carrying the front end of a flat horizontal plate member that I will call the diaphragm. This diaphragm is situated high up in between the frames and is supported not only by them, but by the number three and number four stretchers. On the prototype it serves a very important role in keeping the frames in line, for, without it, the narrow stretchers could not prevent one side of the frames from advancing longitudinally on the other side during stress. For example, a heavy blow on one buffer would only tend to knock back one side of the locomotive, leaving the buffer-plank out of square with the frames. The diaphragm prevents this happening; so, when fitting the member—and before bolting up *both* sides to the frames—see that the buffer-plank is dead square to the frames.

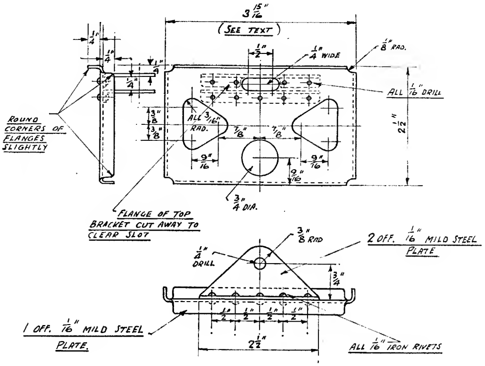
thrust on the axle-boxes, causing them to be pushed down in the horns when pumping against pressure. You then get side wobble in the locomotive when working and promote shouldering to an extent that would be difficult to eradicate on an engine with such a short wheelbase.

If you wish to fit "Major" with this axle-driven pump, just in case you don't get to the donkey-pump stage, you can, as the diaphragm is the same as for "Minor."

The number four stretcher at the back end of the diaphragm comes up to the top edge of the frames, but extends only a little over halfway down them. The front end of the boiler throat-plate will come just behind this member and, on the prototype, there are access holes to get to the wash-out plugs. On our jobs the fitting of such plugs would be a mixed blessing, and I fail to see how anyone is going to reach them with an engine full of steam. For the purpose for which they are fitted, namely washing out the boiler when in the sheds, a man standing underneath with a scale-size hose is the only answer; but, as most of us use such plugs for blowing down



Details of No. 1 stretcher

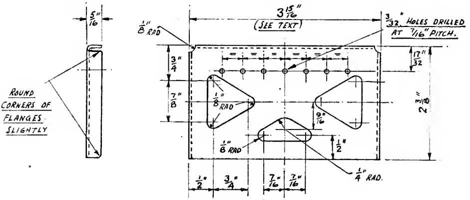


No. 2 stretcher

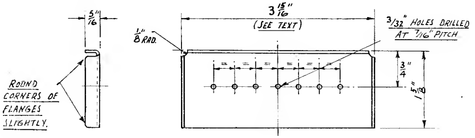
purposes only, I feel that any apertures cut in the stretcher will serve only to satisfy the urge for correct reproduction and fidelity in detail.

Number five stretcher comes approximately level with the boiler backhead and helps to support another diaphragm and this is where, for the sake of simplicity, we go right away from the prototype with its very complicated box-structure. It is here that we compromise, fitting in a system that can be made and assembled quite easily and which will do the job required. On "Major" there will be brackets to carry the main brake shaft, whilst the brake cylinder will be mounted directly on the diaphragm and immediately in front of the brackets. "Minor" won't have the steam brakes but the diaphragm will still be required in conjunction with the number six stretcher to provide a mounting for the rear draw-hook, and this hook really does all the work during the life of the locomotive, and we cannot afford mistakes or weakness at this point.

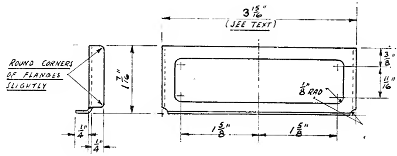
I don't know whether any of you have seen a 5-in. gauge locomotive get away from its driver, but, if you haven't, it is an awe-inspiring spectacle



No. 3 stretcher. 1 off, $\frac{1}{16}$-in. mild-steel plate



No. 4 stretcher. 1 off, $\frac{1}{16}$-in. mild-steel plate



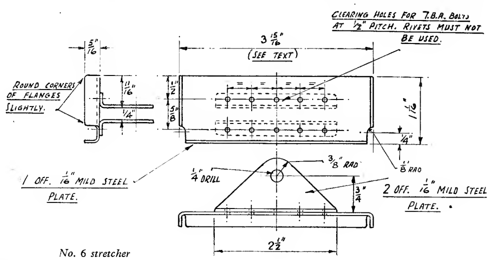
No. 5 stretcher. 1 off, $\frac{1}{16}$-in. mild-steel plate

and usually very expensive—to say nothing of the danger involved.

To return to number five stretcher, this has one large aperture running nearly its entire length and width, and through it we shall be able to slide back the grate to dump the fire. I have tried this method and much prefer it to dropping the entire grate and ashpan. It is also an operation that can, in an emergency, be carried out at great speed—a very essential condition in such circumstances.

The number six stretcher is only $1\frac{1}{2}$ in. away from number five, and the portion of diaphragm bridging the two bottom edges makes a suitable fixing platform for the brake cylinder which, on the prototype, is accommodated in the same way. This number six is the last of the stretchers and has a slot and angle cleats made up in a similar way to number two stretcher, and performs exactly the same role.

The brake-shaft brackets for "Major" are mounted side by side under the diaphragm, and

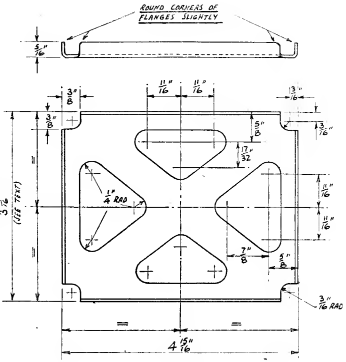


No. 6 stretcher

are roughly triangular in form. They have also a small sheet metal tie plate fixed to their bottom edges to make the unit stiff.

All the foregoing stretchers, diaphragms and brackets are made in the same material, $\frac{1}{16}$-in. mild-steel plate, and in order to get the major components all bent up in the same width so that they fit snugly and evenly and have opposite sides quite parallel, a simple bending-plate will be required. If you have made your main frames from $\frac{1}{8}$-in. material, the width between frames, for both "Major" and "Minor" will be 4 in. dead, but if you have chosen 5/32-in. material, the width will be $3\frac{15}{16}$ in. again for both locomotives.

The bending-plate should be made from a piece of $\frac{1}{4}$-in. plate (it does not matter if there are holes in it so long as these do not break out at the finished edges) $4\frac{13}{16}$ in. long in every case and $3\frac{7}{8}$ in. wide for main frames $\frac{1}{8}$ in. thick. For 5/32-in. frames the width of the bending-plate must be correspondingly narrower, due to the smaller space between the frames, and this gives us a bending-plate $3\frac{13}{16}$ in. wide and still the $4\frac{13}{16}$ in. long. It is most important to get all four edges straight and parallel, and the ends quite square with the sides.



Pump diaphragm. 1 off, $\frac{1}{16}$-in. mild-steel plate

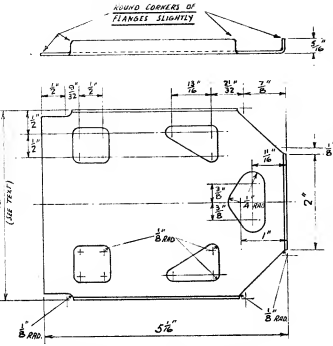
When this condition is secured, carefully file a small radius on all edges—about 1/32 in. will do—so that the sheet material will not be cut and weakened where it is hammered over the edge of the bending-plate.

Usually I have a fairly heavy copper-headed hammer to do this job, so that the metal is not spread and bruised. You will find that you can hit the flanges over quite easily if you work with the hammer over the entire length of bend and don't concentrate in getting either the middle or the ends to sit down first. Above all, don't go on hitting the downturned edge once it has made contact with the bending-plate. This will stretch the metal badly and produce a dished effect in the component that will be very hard to eradicate.

You will notice also that the corners of the blanks are cut away, leaving a radius eating into the plain portion. This is not a makeshift way of avoiding interference between the upturned edges where they meet at the corners, but is good sound engineering practice that does much to prevent unpleasant cracks developing at these places. If you have worked in an aircraft factory, you will know that to omit these refinements is a serious offence. Finally, the bending-plate, being of the correct thickness for the width of the finished bends, can be used as a filing jig, and the components, when laid on the plate, can have any surplus metal drawn over the edges, filed down to its own level—a perfect way of getting an even and parallel edge with complete uniformity throughout. The idea of making the bending-plate a fixed length, namely $4\frac{13}{16}$ in. long, is to enable you to do all four bends on the central, or pump, diaphragm in one fell swoop, and squareness all round be will guaranteed—provided always that the plate itself is correct.

As to general proceeding for the making of the parts, I recommend cutting narrow strips of metal and making the bends over the bending-plate in order to find out how much metal is required for the two edges without having to file too much away on completion. The trial strips can then be flattened out and measured and there's the exact width of your blank—and a check on your bending-plate at the same time.

Having got the sizes of all the blanks, make the corner cut-away clearances as shown on the drawing and bend up the edges, making sure that the bends are in the correct direction. Some of the stretchers have reverse bends—that is to say, bends that necessitate the placing of the bending-blocks on the other side of the blank after the initial bends have been made, and taking the edge over the opposite way. It is a good plan to make all the edges that fit between the frames first, and to deal with the others, top and bottom, afterwards. It should hardly be necessary to say that once the blank has been positioned on the



Back diaphragm. 1 *off,* $\frac{1}{16}$*-in. mild-steel plate*

bending-blocks, both should be transferred to the bench vice and gripped tightly between brass or smooth metal clams, leaving a small part of both plate and metal, preferably not more than $\frac{1}{8}$ in. projecting.

The difficulty with many bench vices is the shallow "throat" that prevents one putting wide work very far down between the jaws. I have found the average-sized metal-jawed wood-working vice a great help in this respect, and sheet metal of $\frac{1}{16}$ in., and perhaps a little over, can be handled in it without undue violence to the vice.

If you have neither facility capable of handling the job, it will mean making up a temporary clamp consisting of two pieces of metal, preferably 1 in. $\times$ $\frac{1}{2}$ in. and about 1 in. longer than the widest blank, and drilling holes in the ends to take clamping-bolts of about $\frac{5}{16}$ in. diameter. You may then hold the lower part of the blank and bending-plate in the normal vice and hold the protruding parts together by means of the clamp described. It is a tool worth making and frequently I have to fish it out of its drawer to deal with some little bending job that just happens to be the wrong shape for normal treatment. I can well advise you to spend a few minutes making this up.

When all the blanks have had "edge" treatment and the turned portions have been filed to the surface of the bending-plate, the marking out of the various apertures can be done. $\frac{1}{16}$-in. plate is a very easy material to work, and there are a number of ways of cutting out such irregularly shaped holes. Here are a few ideas: (1) Drill about $\frac{1}{8}$ in. hole anywhere inside the marked-out aperture and, with an "Abrafile" or similar tension file, hack round, keeping somewhere near the line. Then file up to finish. (2) Drill a series of small holes all round the inside of the marked-out area, being careful not to let the edges of the holes cross that line. Nick the joining edges of the holes with a small chisel. Knock out the centre portion and file up to finish. (3) Out of an old centre-punch grind up a small chisel of about $\frac{1}{8}$ in. width blade and, laying the blank on a block of steel (*not* a hard anvil) nibble round the scribed line, keeping about $\frac{1}{16}$ in. inside all round. Knock out the centre and file up.

The blanks are now ready to be offered up to the frames and the holes already drilled in the frames can be marked through. One or two temporary screws can be used as fixings. On no account do any final riveting up at this stage, as the frames will have to be dismembered a number of times before the final erection.

(To be continued)

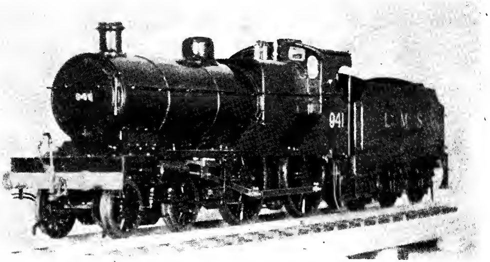
A Warning to Readers

THERE are several ex-service brazing lamps being sold at 35s. each, and I was given one as a present recently. I had a general look round and tightened up the various joints and connections and started up for a test with a very moderate pressure. I left the lamp for a moment or two while it was warming up, and suddenly there was a rush of flame and burning paraffin. Fortunately, I had a fire extinguisher at hand and was able to prevent a really serious fire. I took the lamp to pieces and found the large main union did not mate with its socket, thereby allowing the fuel to pour out over the body. I also found the valve cage on the bottom of the pump was missing. This was due to the threads being stripped and the pressure had just blown it out of the pump end. I would, therefore, strongly advise buyers of these lamps to overhaul them thoroughly before putting them into service and so prevent what may easily result in a major accident.—A. PENGELLY

A Sister to the "Maid of Kent"

by "L.B.S.C."

FOLLOWERS of these notes who are building the "Maid of Kent" with outside cylinders, to represent one of the L.M.S. three-cylinder compounds, should find the reproduced photographs of special interest. They show a 5-in. gauge locomotive of this type, built by a Halifax reader, Mr. S. Ibbotson. Work was started on it foundation. The cylinders, which are 1½ in. bore and 2⅜ in. stroke, were cast in manganese bronze; the pistons and slide-valves are phosphor bronze. Valves are actuated by Stephenson link motion, with the G.W.R. type of launch links, and the valve travel in full gear is ⅝ in. The brake gear is similar to that described for "Petrolea."



Mr. S. Ibbotson's 5-in. gauge locomotive

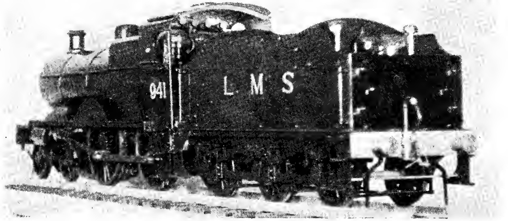
in December, 1945, and it was completed last October, nearly three years' work. Our friend says that the origin of the job was a piece of copper tube which came into his possession. It was 5-in. inside diameter and 14-gauge, so he thought it would come in for a boiler for either a big 3½-in. gauge engine, or a small 5-in. job. The wider gauge was decided on, to eliminate what he called "fiddly bits," as much as possible; and the type of engine was finally settled on by Mr. Hambleton's excellent line drawing of a L.M.S. "Crimson Rambler," as the copper tube was just about the right diameter for the boiler barrel, and she was a neat looking engine. She is not intended to be an exact copy of the type mentioned; it was just taken as a base, and Mr. Ibbotson has altered and amended it to suit his own ideas. The engine is not a compound, having two outside high-pressure cylinders only; the running-boards are not like the full-size job, and the boiler lagging is flush with the smokebox. She also has single guide bars, box crossheads, and other variations.

The frames are made from 7/32-in. steel plate, the buffer-beam being of 2-in. by ¼-in. angle, and the drag beam 1½-in. by ¼-in. angle, which, as our friend says, certainly ensured a good

Mr. Ibbotson had some ⅜-in. by 22-gauge copper tube in stock, which he wished to use for fire-tubes; and as I had recommended 11 in. for maximum length of tubes for this diameter, he decided to fit a combustion-chamber, to enable the tubes to be kept down to this length. This chamber is about 3 in. long. There are also three 1 in. diameter superheater flues, containing ¼-in. elements. The boiler is a good steamer, and has no trouble whatever in maintaining 90 lb. pressure, using ordinary soft Yorkshire house coal. Even with this unsuitable fuel, there is not much sooting up, the only disadvantage being plenty of char in the smokebox.

The boiler is fed by two injectors and a hand-pump; but a small experimental Weir-type donkey pump is now under construction, and will be fitted to the engine if it pans out O.K. Originally, she had an eccentric-driven pump which came to grief through an oversight. Mr. Ibbotson fitted two check-valves in the same casing; and to prevent one of the balls becoming unseated when the other was taking the feed, he fitted a screw arrangement above each, so that by screwing down the pin, the ball could be held down on the seat. This was an unnecessary refinement, as he afterwards found, and was the direct cause

of the trouble; for he failed to release the appropriate valve when first getting up steam (the excitement and anticipation of the first run, is usually enough to make anybody forgetful!) with the result that the pump barrel split, the ½-in. diameter ram was bent, the eccentric completely broken and the unfortunate builder's finger so badly damaged that a hasty visit to the doctor was necessary for "repairs." That journal) very much indeed, and would probably interest our i.c. friends; but it is out of my province to describe it here. Anyway, the engine could knock 900 watts easily out of a Crompton dynamo, though my usual charging rate was 36 volts, 20 amp., the accumulators being a Pritchett and Gold train-lighting set, in glass boxes the size of two-gallon petrol cans. Not long before leaving for U.S.A. I sold the engine



View showing tender accessories

promptly weaned our friend off eccentric-driven pumps, and he decided to rely on injectors!

The tender is a simple and straightforward job, of the ordinary L.M.S. pattern, and furnished with the usual accessories. The tank holds approximately 1¾ gallons. Our friend says 5-in. gauge is all right, but the disadvantage is, that it is a two-man-power job to lift the engine!

The whole of the machining was done on a 3-in. centre straight-bed lathe, home-made by the builder's father several years ago, plus an Ajax milling machine, which not only milled the frames, and did all the normal work of a milling machine, but bored the cylinders, and turned the 6¾-in. driving wheels. Mention of that, reminds me that when I once called at old George Kennion's shop at Shoreditch, about eighteen years ago, I found him hard at work boring cylinders for a 2½-in. gauge 4-6-2 on his Lorch milling machine. When I asked why he didn't use a lathe (he had several in commission) he just laughed and said it was a bit of a variation and broke the monotony. Incidentally, I once turned a pair of big driving wheels on the Denbigh milling-machine I had during the last couple of years at my old home at Norbury; and I'm open to bet you would have laughed at the way the machine was driven. I had no "mains" power; used a pedal-driven lathe, and a hand-operated bench drill and planer; and generated the current for the house lights with an oil engine rated at ¾ h.p., which I fixed up to run on paraffin and water. This amused the late Mr. Walter Runciman (at that time acting editor of this to an interested friend, and used an old "Lion," much larger, during the remainder of my stay at the old home.

However, to get back to the drive for the milling-machine, I acquired an old 24-volt "Delco" motor, rated at about 1/3 h.p., and mounted it on a bench close to the milling-machine, driving direct from a small pulley on the motor, to the biggest step on the cone. This motor took about 20 amp. when driving the miller, which would have hit the battery good and proper! So, every time I wanted to use the miller, I had to start up the charging plant—sort of diesel-electric stunt, though it wasn't diesel, but the stuff I used in my five-pint perspiration-generator. If I had owned, in those days, the equipment I now have, I could have built locomotives by the dozen, as I had the energy; now, thanks to *Anno Domini*, most of the energy is missing. Alas, we can't have it all ways!

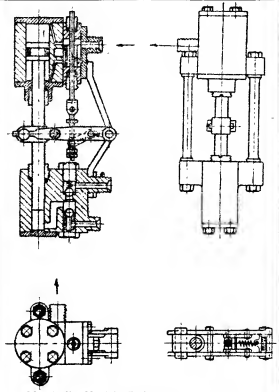
Returning to Mr. Ibbotson's job, the only other machine-tool he has, is an 0-⅜-in. bench drill. Our friend puts in a good word for the quality of Dick Simmonds' castings and materials, supplied at a time when such things were very difficult to obtain; and he also acknowledges the help given him by his father, whose knowledge of machining methods, and unusual ability for quickly setting up awkward jobs, was of great assistance; and who also helped with the bigger jobs such as making the boiler. "Dad" was also responsible for the painting and lettering; the engine is finished in black, with L.M.S. straw-coloured numerals and letters. The undercoating

was done with "Roscoe" cylinder black, and the finishing coats with the same stuff mixed with clear enamel. This has so far stood up to heat and oil without any signs of blistering.

Well, ye merry outside-cylinder "Maid" builders, that gives you some idea of what your engine should look like when completed, and I think we can offer sincere congratulations to our worthy friend and his father, on a good-looking, and successful engine.

A Simple Weir-type Donkey Pump

A little while ago I promised details of a little Weir-pattern donkey pump designed and built by Mr. Leslie Clarke, late of Swindon Works, who was kind enough to forward the reproduced drawings. As will be seen, the little gadget is exceedingly neat, and bears a very strong resemblance to the full-sized article; but whereas the large pumps have both main and reversing valves, the small one needs only one simple slide-valve to distribute the steam to each end of the cylinder, travel being completed by spring action as soon as the valve spindle passes mid-position.



Mr. Leslie Clarke's Weir-type donkey pump (full size)

The steam cylinder is $\frac{1}{4}$-in. bore and $\frac{3}{8}$-in. stroke, and is easily made from a casting, or a piece of $\frac{1}{2}$-in. round gunmetal or bronze rod $\frac{5}{8}$ in. long, which can be drilled and reamed in the three-jaw; both the port block and the steam-chest can be made from $\frac{7}{16}$-in. by $\frac{3}{16}$-in. flat rod, the port block being hollowed out to the radius of the cylinder, and silver-soldered to the cylinder body. This should be done before putting the reamer through. The steam ports are merely drilled holes: steam No. 55 and exhaust No. 48. A rectangular slide-valve is shown, but a circular one would do just as well; the back is slotted to take the valve-spindle, which is filed flat to suit. The piston-rod is $\frac{1}{8}$ in. diameter, and prolonged to form the pump-ram, the overall length of piston and rod being $1\frac{3}{4}$ in.

The pump cylinder can be cut from solid, or made up from a casting. It is the same length as the steam cylinder, but drilled No. 34 and reamed $\frac{1}{8}$ in. to receive the ram or plunger. The valve boxes are formed in the same block, a No. 55 hole being drilled vertically through it at $\frac{5}{16}$ in. from the centre of the bore. The top half is opened out to about $\frac{3}{16}$ in. depth with No. 40 drill, and bottomed to $\frac{1}{4}$ in. depth with a D-bit made from the shank end of a broken or used-up No. 40 drill. A carburettor-reaming broach can be put down the No. 55 hole, to true the ball seat. The end of the hole is tapped $\frac{1}{8}$ in. or 5 B.A., and a cap made to fit.

The lower hole is opened out to $\frac{5}{16}$ in. depth with No. 40 drill, and the end tapped as above. The cap is hollow, being drilled almost through with No. 55 drill, and broached as above. The valve-balls are $\frac{1}{16}$ in. diameter—some valves! They are commercial articles, however; one of our advertisers, Mr. A. J. Reeves, of Birmingham, sent me some for an experiment, quite a long time ago. The vertical part of the water passage connecting valve chamber and pump barrel, is drilled from the bottom of the casting or block, and the horizontal one from the side, the ends of both holes being plugged. The unions for the inlet and outlet pipes are 5/32 in. by 40, and drilled No. 52 or $\frac{1}{16}$ in.; the inlet hole is drilled right through into the hollow bottom cap, as seen in the sectional illustration.

Valve-gear

The support for the fulcrum pin carrying the two long side levers, can be filed up from a bit of flat steel, and bent to the angle shown. It is held at the upper end by one of the steam-chest screws, and a hole is drilled in the lower end, forming a ring, which fits over the delivery pipe union (made extra long for the purpose) and is held on by a nut. A block of metal is set-screwed to the pump-ram in the position shown, and this is cross-drilled and reamed to take a $\frac{1}{8}$-in. steel pin. Both ends of this pin are cross-drilled No. 55; tricky job, that—I've had some on old "Grosvenor's" spring-balance safety valves. The two side levers are filed up from

$\frac{1}{16}$-in. steel strip ; the larger ends are drilled for the $\frac{1}{16}$-in. fulcrum pin, and the smaller ends are reduced to a nice sliding fit in the No. 55 holes in the cross pin on the pump-ram. Incidentally, friend Leslie doesn't say anything about how to assemble the levers and the fulcrum pin, but I should ream the hole in the support, to take a $\frac{1}{16}$-in. pin, drill the lever bosses No. 53, and just press them on.

Trip-Gear

The spring trip-gear is a real watchmaking job. The two small levers, which are only 7/32 in. centres, are pivoted at one end, to the bigger levers, by 1/32-in. pins. At $\frac{1}{8}$ in. ahead of these pivots, the weeny arms are cross-connected by a long [?] 1/32-in. pin, to which one end of the spring is attached ; the other end is anchored to a little eye formed on the fulcrum-pin support. See both plan and elevation views. The valve-spindle goes down between the little levers ahead of the cross pin, and the levers actuate the spindle by virtue of locknuts on same, similar to the single-cylinder pump which I described when I fitted one to my "roller-skate" Pacific "Fernanda." It won't do for some of my correspondents to tackle this bit of fitting, judging by the tangles they get into with an ordinary valve-gear —but I know one at least, who would delight in it, and that is my old friend of 16-B.A. screw fame. His make-up includes two priceless components, viz., consummate skill and infinite patience!

The action of the gear is very simple. If you take a look at the section, you'll see that the upper steam port is open, and the piston is therefore descending. Now look at the levers ; the pivots of the two small levers are almost level with the spring. As soon as they get below it, the pull of the spring will immediately snatch the little levers upwards ; their ends will catch the upper nut, knocking the valve-spindle up, and uncovering the lower steam port, admitting steam to the underside of the piston, causing same to rise. This naturally brings the long levers up as well ; and as soon as the pivots of the small levers rise above the spring, same immediately snatches them down again, reversing the valve once more, and causing the piston to descend. As we used to say at school "and so *ad infinitum*."

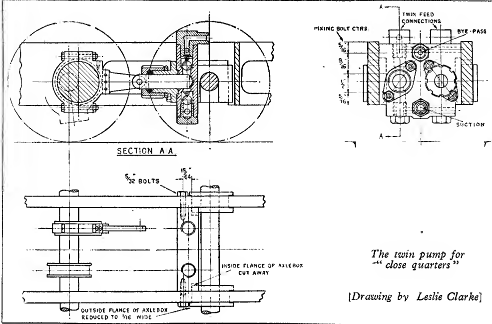
Both steam and pump cylinders have lugs at the side, and these are connected by turned steel pillars with nuts on each end, as shown in the front view of the pump. If the holes through the lugs are made an easy fit for the ends of the pillars, the two parts of the pump can be lined up to a nicety. On a weeny gadget like this, first-class fitting, and the minimum of friction, are essentials to successful working. The piston should not be packed too tightly ; if turned and fitted by the methods I have so often described, the packing should simply be a kind of emergency seal. On a little cylinder like this, the film of oil between a properly-fitted piston and the cylinder bore, should be sufficient to keep steam from blowing past ; it does on my piston-valve engines, anyway. Simple screwed headless glands are shown ; merely bits of screwed rod, drilled for the piston-rod-cum-pump-ram. They can be cross-slotted for adjustment purposes. The valve-spindle passes right through the steam-chest, and has a **gland top and bottom** ; the reason for this, beginners please note, is to avoid steam pressure on the end of the valve-spindle, which would act against the spring in one direction, and might cause complete failure of the pump to do the job. These little gadgets want plenty of oil, so a small displacement lubricator should be fitted on the steam-pipe, close to the pump. "Fernanda" has one ; and whenever the donkey-pump quits work whilst the engine is running, I know the lubricator wants refilling. One more point ; these watch-chain ornaments want the steam as dry as possible, and if any engine has a turret or fountain from which superheated steam can be obtained, connect the steam-pipe of the pump to it. Also, the best location for a pump of this sort, is on the side of the smokebox, where it can keep as hot as possible. I once cured a "some-timer" for a friend, who complained that his pump worked champion on air, but "gave up the ghost" as soon as it was tried on steam. The trouble was merely wet steam and excessive condensation. The steam supply was taken well below the level of the boiler top, and the pump was exposed, halfway along the boiler barrel, with several inches of $\frac{1}{8}$-in. pipe also exposed between the valve in the cab, and the pump. Water went over with the steam, and more was added through condensation in the pipe ; and the water choked the little passages, and got between the piston and the covers, thus "stopping the clock."

My remedy was very simple. I shifted the donkey pump bodily to the side of the smokebox, for a start. Then I put a union on the smokebox tubeplate, taking a $\frac{1}{8}$-in. pipe from same, right across the front of the tubes, to a little screw-down valve on the side of the smokebox, made like the blower valve on the old Brighton "D" class tanks. I have a similar valve on "Jeanie Deans," supplying steam to warm the low-pressure cylinder before starting from cold, and it is operated by the handrail, above all things. The handrail is free to turn in the knobs ; the cab end is furnished with a hand-wheel, and the smokebox end is squared to fit a socket on the steam-valve spindle. On my friend's engine, there was only about an inch of pipe between the valve and pump. The smokebox kept the pump nice and warm ; the steampipe inside the smokebox became hot enough to dry the steam ; no water got into the little donkey, and so it worked perfectly, starting immediately steam was turned on.

Another advantage of smokebox mounting, is that the feedwater can be heated, the delivery pipe from the pump passing into the smokebox, and going around it for a turn or so before coming out again and entering the boiler through a side clack. Entry and exit can be made by small double-ended unions, which allows the inside pipe to be removed easily at any time for cleaning.

A Twin Eccentric Pump For "Close Quarters"

Friend Leslie also sent a drawing of a pump he devised for very limited space between axles on a $3\frac{1}{2}$-in. gauge 4-8-2 locomotive with bar frames. This is shown in the reproduced drawing, which



The twin pump for "close quarters"

[Drawing by Leslie Clarke]

practically explains itself. The valve chambers and waterways are all drilled in a very substantial cross-stay, which is set back close to the coupled axle by removing the inside flanges of the axlebox on each side. The pump barrels, which have external glands, are made separately, and attached to the cross-stay by oval flanges, with nuts and studs, as shown in the end view.

The two eccentrics are set at 180 deg. or exactly opposite, so that the flow is practically continuous; and the method of drilling the waterways, calls for only one feed-pipe and one by-pass. Two deliveries are shown, for clacks on each side of the boiler, but these could be combined into a single delivery if the design of the engine called for it.

The "Eureka" Electric Clock

(Continued from page 313)

without the need for setting or bending the springs themselves, which is not advisable, though a slight twisting of the contact tip may be permissible. Note that very little effort should be needed to flex the spring to the extent of just over $\frac{1}{16}$ in. at the tip, as required to operate the contact; the lightest possible action consistent with just enough contact pressure to conduct the necessary current, will give the best results.

It is now possible to get the balance wheel impulse motor working, though not to get it properly rated at this stage. A hairspring of appropriate length and strength to produce a losing rate should be fitted, and the spring collet adjusted to put the balance "in beat" (i.e., with the core vertical) when at rest. Not more than $1\frac{1}{2}$ volts should be used to energise the motor. Adjust the position of the spring so that contact is established at about 15 to 20 deg. to the right of the dead centre, and broken exactly at dead centre. This will call for careful and possibly patient, manipulation of the spring and mounting block.

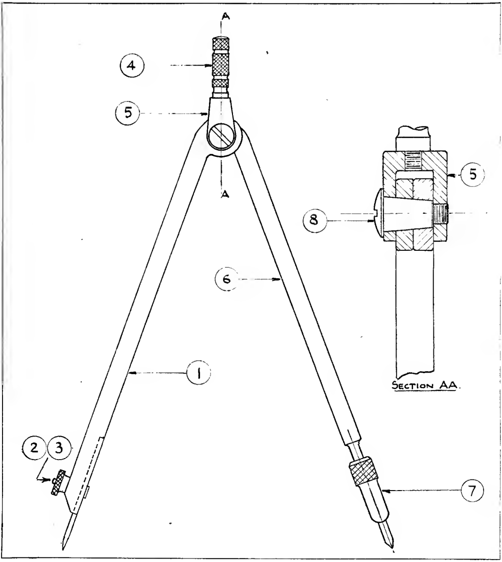
When properly adjusted, the action of the balance wheel should be healthy and vigorous, and the current consumption low, so that only a very minute spark, if any, is perceptible at the contacts. The motor may be left running while the rest of the clock—virtually no more than a counting and indicating gear—is completed. Its movement, however, is so fascinating to watch that it may prove to be a distraction if set up in the workshop; it is best to put it in some other part of the house, where it serves the purpose of a decoy for those admiring but often embarrassing friends who are always "dropping in" when some particularly delicate job is in progress!

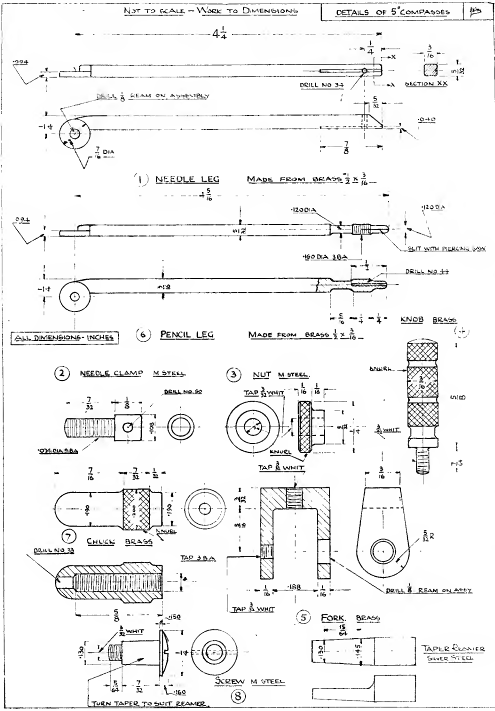
(To be continued)

A Design for a Pair of Compasses

THE compasses shown in the drawings form a nice exercise in moderately fine, delicate work, and serve as an introduction to the making of more elaborate instruments. At the same time the job is not too troublesome to execute, nor will it take a long time to complete. The amateur will thus perhaps have the novel experience of actually completing something in a single week-end.

It is surprising how much one can learn by tackling a job which is a bit different. For instance, the writer had assumed that the screw which forms the pivot for the legs of a pair of compasses differed from an ordinary screw only in being more highly finished and in having a very thin head. Hence his first pair of compasses was fitted with a pivot screw conforming to these simple requirements. The result was disastrous. When moved one way the legs became excessively stiff; when moved the other, the two legs behaved like the blades of a well-worn pair of scissors. This was odd, since the screw had been made similar to the screw from a commercially-made instrument which had behaved quite rationally





for many years. The latter was removed and scrutinised again. Very close inspection showed that the screw was very slightly tapered. An obvious point? They all are, afterwards and when the job is done.

The pivot holes are reamed out after drilling

with a silver-steel reamer made something like that shown in the drawing. The dimensions of this are offered only as a guide and the important thing is to turn the pivot screw after making the reamer, without disturbing the top slide.

The other thing which must be watched in making the compasses, is the spot facing of the $\frac{7}{16}$ in. diameter on each leg. This is done with the usual type of cutter having a removable pin. Don't just hold the brass blank on the drilling-machine table—clamp it there with a couple of bolts so that it can't misbehave. If this precaution is taken the pencil and needle points will meet when the legs are closed together.

The opulent can mill the slot for the needle in their universal milling-machines, the moderately well-to-do can hold the blank in the four-jaw chuck and drill in the right position before filing the blank to shape, while the less fortunate people can prop the blank up on the tailstock centre and have the drill in their second-hand self-centring chucks.

If your lathe is one of the small ones which have recently come on the market (these are splendid for this kind of work) you don't need a knurling tool to make the little parts shown in the drawings. Just take the belt off, place a file firmly on the work, imagine that the file is a rack and the job a pinion—and push. If you do it properly the mandrel will revolve and a really professional-looking knurled surface will result.

Very light cuts will have to be taken when turning the pencil leg, since the job is much weakened as it gets down to size. If you haven't a four-jaw chuck, set this component up between centres after roughly cutting to shape with a saw.

See that the separate parts receive a high finish before assembly, and a trace of oil should be placed between the joint surfaces of the legs.

The compasses work; the accompanying drawings were made with them and the draughtsman, not the instruments, should be blamed for any defects present.—J.K.M.

The Story of an Oil Tank by R. J. Frost

A VERY light oil tank capable of withstanding up to 150 lb./sq. in., was required for a model hydroplane's steam plant. The dimensions were to be approximately $1\frac{1}{2}$ in. × $2\frac{1}{2}$ in. in length, with hemispherical ends and approximately 28 s.w.g. The shortage at the time of solid drawn copper tube in the required gauge, together with the difficulty in beating out hemispherical ends led to thoughts on other ways and means.

A jar of copper sulphate crystals gave an idea, and the following is the process that evolved, and culminated in a successful job.

A solid dummy of the required oil tank was machined in lead on the lathe. The centre of the filler bush position was marked and a $\frac{1}{16}$-in. hole was drilled to a depth of about $\frac{3}{8}$ in. A length of 16-s.w.g. copper wire was inserted and secured by a tap with a punch to one side of the hole.

A handful of copper sulphate crystals was next added to a glass jar of water to form a copper plating bath.

The lead dummy tank was now polished with fine glass-paper and then washed in hot soapy water, and rinsed clean. It was finally suspended in the copper sulphate by the copper wire, from a wooden stick placed across the top of the jar. Also suspended from the stick was a length of $\frac{1}{4}$-in. sq. copper rod with about 1 in. submerged in the solution.

The copper rod was connected with a short length of wire to the positive of a 2-volt accumulator. The wire suspending the lead was connected to one side of a 2.5-volt flashlamp, the other side being connected to the negative of the accumulator.

The bulb just gave a visible red glow and the lead soon took on the salmon pink colour of copper.

After a day, the lead dummy was removed from the solution and rubbed with pumice powder to smooth and condense the deposit. It was then replaced in the solution and left for another day. Again the deposit was polished with pumice and this process was repeated for six days.

At the end of the week the tank was finally polished, and the wire cut flush with the surface. The bush hole was then drilled out $\frac{5}{16}$ in. diam. and 1 in. depth into the lead core. The whole tank was then very slowly heated on a gas ring. As the lead melted, it poured from the drilled hole. When all the lead had run out, the copper shell was left, perfect in shape and without a join or seam.

Should this novel process be repeated, the following points should be noted. (i) Do not suspend the copper anode directly over the lead but to one side. This allows the impurities which fall from the copper as it dissolves, to sink to the bottom of the jar, instead of sticking to the top of the lead. (ii) If the deposit is brown instead of salmon pink, the process is proceeding too fast, so reduce the plating current by having less of the copper rod in the solution. (iii) Be careful not to remove all the copper deposit in the early stages with the pumice powder. (iv) Be very careful not to burn the lead in the melting process.

Two further fields, although not yet explored by the writer, would seem to be possible by the above method.

The first is the production of a metal carburettor float in a really small size.

The second is the production of intricate copper moulds from fabricated lead patterns. These moulds could be supported by clay and should be suitable for light alloy castings. The copper sheath left on the casting could be removed if necessary by acid.

It is thought that while this method is not suitable for normal production, it may be of use in the solving of some awkward 1-off job.

PRACTICAL LETTERS

A Simple Electric Pyrometer

DEAR SIR,—With reference to Mr. Birchon's letter commenting on my article on a home-made pyrometer, I think that he, too, has made an error, because all my books of reference give the melting point of silver as 960.5 deg. C. I think he must be referring to copper.

Another reader had already pointed out the improvement in stability obtained by welding the couple, and on trial I must agree; unfortunately, we do not all have these facilities.

With regard to the other errors remarked on by Mr. Livie, the first was corrected in the proof, and, not having my books of reference with me at the time, missed the others.

With apologies to your readers,

Yours faithfully,

Banstead. A. R. TURPIN.

Competitive Model Sport

DEAR SIR,—I would like to say how much I applaud your views concerning the policy of THE MODEL ENGINEER with regard to miniature hydroplane racing and other forms of competitive sports. The fellows who buy engines and hulls, and merely operate the resulting conglomeration are, in my opinion, a dead loss to model engineering. The only result one can expect from their activities is a lowering of the high standards attained by true model engineers, who achieve success as a result of painstaking work and no mean intelligence, and whose traditional modesty is inspiring to behold.

I can see in their place at the pond-side, a crowd of noisy gum-chewing youths, boasting of the performance of a boat, built of commercial components, and regarding themselves as the centre of admiration for their ability to buy mass-produced horrors, regarded loosely as engines, meanwhile using childish slang expressions for their various components. I have observed these tendencies among some of the younger members of model engineering societies, and I am rather perturbed at the possibilities. In the interests of our hobby, which I regard as one of the major contributions to a mass leisure, I regard it as imperative that secretaries of model engineering societies should attempt to infuse into younger and possibly wilder elements a spirit consistent with the tradition of our hobby, and point out that it is not a means of emulating film-stars and other publicity-seekers.

To see grand fellows like Ken Williams of *Faro* fame in the same enclosure with these publicity-seekers is galling to say the least, and model engineering societies should exercise more discretion when considering fresh members, even when funds require bolstering up with fresh subscriptions. Surely an increase in annual subscription or even a fund consisting of voluntary subscriptions would be better than a lowering of standards. Better 20 good sound members than 200 onlookers wishing to bask in the reflected glory of the few.

I heartily commend the ideas on engine development expressed by Mr. Mitchell in his article on the subject of engine testing. Only by patiently analysing the faults in a design and putting them right one by one, can solid progress be achieved. I am also gratified to observe that Mr. Mitchell is not above using much-derided theory in the solution of his problems. If more engineers would acquaint themselves with the principles of their profession instead of learning like parrots, they would save a lot of time. I hope to bring to bear on problems all that I am learning about bending moments, velocity, calculus, etc., instead of guessing, although I appreciate the difficulty when applied to small scale engineering.

Yours faithfully,

Dudley. R. F. WILLETTS.

The "Eureka" Electric Clock

DEAR SIR,—It is refreshing to see constructional data for that interesting but very maddening freak, the "Eureka" clock, now appearing in "Ours."

It would appear from the description of the compensated balance in the February 17th issue, that "Artificer" is under the impression that compensation arrangements have to be introduced in balances to counteract the thermal expansion of arms and rim.

I would like to point out, however, that this is a very minor cause of loss of "rate," the big offender being the reduction of the modulus of elasticity of the balance spring with increase of temperature. An uncompensated chronometer balance of brass is quoted as losing 11 seconds a day per degree Centigrade rise.

With its relatively enormous balance, I fear the "Eureka" would become very wild with no compensation. They are wild enough, anyway. An alternative would be to fit compensation curb pins and leave the balance a plain uncut one. This would be easier to make and can be quite an effective system, although now obsolete. I have a watch by the celebrated Breguet of Paris with plain brass balance and compensated curb pins, and the method is certainly effective when correctly proportioned. Compensation itself is now becoming obsolete, having been replaced by alloys for both balance and hairspring—the former with low coefficient of expansion and the latter with negligible change of modulus of elasticity. One of the best known proprietary metals for the spring is "Nivarox," but where one would obtain material for a spring of the size required is quite another matter.

Another point is that the "Eureka" balances appear to be made very heavy on one side—out of poise—on purpose. At least, those I have had to do with have been like that. It was not a matter of the wrong screws in the wrong holes, but I do not know the reason for it.

Yours faithfully,

Bognor Regis. C. S. COWPER-ESSEX.